IEEE P802.11
Wireless LANs

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|

|  |
| --- |
| U-SIG Comment Resolution Part 1 |
| Date: 2020-09-22 |
| Author(s): |
| Name | Affiliation | Address | Phone | email |
| Sameer Vermani | Qualcomm |  |  | svverman@qti.qualcomm.com |
| Alice Chen | Qualcomm |  |  | alicel@qti.qualcomm.com |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

 |

Abstract

This submission proposes resolutions for the following comments from the CC34 on P802.11be D0.3:

NOTE – Set the Track Changes Viewing Option in the MS Word to “All Markup” to clearly see the proposed text edits.

**Revision History:**

R0: Initial version.

# CID 1349, 1350, 1351, 1353, 1354, 1355, 1356

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CID** | **Clause** | **Page.Line** | **Comment** | **Proposed Change** | **Resolution** |
| 1349 | 36.3.11.7.2 | 229.15 | After EHT and future amendments are rolled into 802.11, and evolve in 802.11mxxx, then the notion of "multiple amendments" disappears | Better to write "multiple IEEE 802.11 PHY clauses" and/or a MIB variable for multiple releases. Ditto P229L18, P230L14, P236L16, P237L9, P239L12; also P229L23 should be "starting with EHT". | Accepted |
| 1350 | 36.3.11.7.2 | 229.17 | After EHT and future amendments are rolled into 802.11, the meaning of "future" becomes very unclear | Change "future IEEE 802.11 generations" to "IEEE PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards" | Accepted |
| 1351 | 36.3.11.7.2 | 229.26 | Due to the requirements defined in the 802.11 operation manual "EHT Release 1" will never and can never be subject to a letter ballot. | Just make the undefined ER-preamble-related material as TBD | Revised.Agree with the commentor that we cannot have reference to “EHT release 1”. Please see discussion on this below where we show how we propose to address this reference issue. However, we cannot remove the ER-preamble-related material. That is needed for forward compatibility with an ER PPDU if it gets defined in the future. TGbe Editor: Please make changes for CID1351 as shown in the following document |
| 1353 | 36.3.11.7.2 | 229.36 | There are no "Validate bits in the preamble"; only fields with name "Validate" that might be 1b in length | Try "Validate fields ... for those fields". Change all instances of "Validate bits" to "Validate fields" | Accepted |
| 1354 | 36.3.11.7.2 | 229.36 | "default values" is not forwards compatible to R2. | Defined a MIB variable for R1 devices, then indicate what value these should be set to if that MIB variable is true. Review all instances of "default" and "nondefault" accordingly. Also P231L30-34 | Accepted:Resolution to CID 1351 addresses this. |
| 1355 | 36.3.11.7.2 | 229.39 | There are no "Disregard bits"; only fields with name "Disregard" that might be 1b in length | Change ""Disregard bits ... bits/states" to "Disregard fields ... fields/values". Change all instances of "Disregard bits" to "Disregard fields" | Accepted. |
| 1356 | 36.3.11.7.2 | 229.36 | "default values" is not forwards compatible to R2. | Define a MIB variable for R1 devices, then indicate what value these should be set to if that MIB variable is true | Accepted.Resolution to CID 1351 addresses this. |

**Discussion on CID 1351**

There is a way to call out Release 1 devices through a MIB variable as the commentor suggests in CID 1354 and 1356. Once that is done, there is no ambiguity. We need the following:

* One MIB variable – e.g. dot11OnlyEHTBaseLineFeaturesImplemented
* One capability bit – e.g. Only EHT Base Line Features Implemented
* And the standard saying
	+ In D1.0 and 2.0
		- “An EHT STA shall set dot11OnlyEHTBaseLineFeaturesImplemented to true.”
	+ In D3.0, above sentence is changed to
		- “An EHT STA with any of dot11EHTULOFDMARUChange, dot11EHTInterleavedRU, … (MIB for other R2 features) set to true shall set dot11OnlyEHTBaseLineFeaturesImplemented to false.  Otherwise, EHT STA shall set dot11OnlyEHTBaseLineFeaturesImplemented to true.”
	+ And from D1.0 (and forever)
		- “An EHT STA with dot11OnlyEHTBaseLineFeaturesImplemented set to true shall set the Only EHT Base Line Features Implemented subfield to 1 in the EHT Capabilities element.  Otherwise, the EHT STA shall set the Only EHT Base Line Features Implemented subfield to 0.”

### 36.3.11.7 U-SIG

2

### 3 36.3.11.7.1 General

4

5

1. The U-SIG field carries information necessary to interpret EHT PPDUs. The integer fields of the U-SIG
2. field are transmitted in unsigned binary format, LSB first, where the LSB is in the lowest numbered bit
3. position.

9

### 10 36.3.11.7.2 Content

11

12

1. The U-SIG field is designed to bring forward compatibility to the EHT preamble via the introduction of
2. version independent fields. These are fields that will be consistent in location and interpretation across
3. multiple IEEE 802.11 PHY clauses. The intent of the version independent content is to achieve better
4. coexistence among IEEE 802.11 PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards. In addition, the U-SIG can have some version

17

1. dependent fields that are fields specific to an IEEE 802.11 PHY clause . The U-SIG includes version
2. independent bits followed by version dependent bits. PHY version identifier field shall be one of the version
3. independent fields in the U-SIG. The purpose of the PHY version identifier is to simplify autodetection for
4. IEEE PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards, i.e., the value of this field is used to identify the exact PHY version starting
5. with EHT .

23

24

1. The size of the U-SIG for EHT MU PPDU and EHT TB PPDU is two symbols. For forward compatibility,
2. EHT defines an ER preamble while not defining an ER PPDU. This enables an EHT
3. STA with dot11OnlyEHTBaseLineFeaturesImplemented set to true to decode and interpret the version independent content in the U-SIG of an ER PPDU that may be
4. introduced in IEEE PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards . The size of U-SIG for an ER preamble is four symbols.

29

30

#### **31** Editor’s Note: Need a definition of “EHT Release 1”.

32

1. Reserved fields in the PHY preamble or any reserved/unused states of the fields in the PHY
2. preamble are divided into two categories: Validate and Disregard. If an EHT device with dot11OnlyEHTBaseLineFeaturesImplemented set to true encounters a PPDU where any of

35

1. the Validate fields in the preamble are not set to the values for those fields specified in this subclause, or
2. field values of any field in the EHT PHY preamble are set to a Validate state as defined in this subclause, it
3. shall defer for the duration of the PPDU, pass the information in the version independent fields to MAC, and
4. terminate the reception of the PPDU. On the other hand, if an EHT device with with dot11OnlyEHTBaseLineFeaturesImplemented set to true sees Disregard fields set to any
5. value, or field values of any field in the EHT PHY preamble as being set to a Disregard state as defined in this

41

1. subclause, it shall ignore these bits/states, and continue receiver processing subject to, absence of any of the
2. other Validate fields in the preamble that are set to values other than those specified in this subclause and, any of the other fields in the preamble
3. not being set to a Validate state. An EHT STA with dot11OnlyEHTBaseLineFeaturesImplemented set to true shall set the Disregard fields to the values as specified in this subclause.  An EHT STA with dot11OnlyEHTBaseLineFeaturesImplemented set to false may set Disregard fields to different values from the ones specified in this subclause. For further details on receive behavior when encountered with Validate and
4. Disregard fields/states, please refer to [36.3.21 (EHT receive procedure)](#bookmark282).

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1. The U-SIG field for an EHT MU PPDU contains the fields listed in [Table 36-19 (U-SIG field of an EHT](#bookmark91)
2. [MU PPDU)](#bookmark91). The version independent bits are B0–B19 of U-SIG-1. The rest of the bits are version
3. dependent.

4

5

6

### 7 Table 36-19—U-SIG field of an EHT MU PPDU

8

9

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
| U-SIG-1 | B0–B2 | PHY Version Identifier | 3 | Differentiate between different PHY clauses . Set to 0 for EHT. Values 1–7 are Validate. |
|  | B3–B5 | BW | 3 | Set to 0 for 20 MHz.Set to 1 for 40 MHz.Set to 2 for 80 MHz.Set to 3 for 160 MHz.Set to 4 for 320 MHz-1.Set to 5 for 320 MHz-2.Values 6 and 7 are Validate. |
|  |  |  |  | ***Editor’s Note: Need a definition of “320 MHz-1” and “320 MHz-******2”.*** |
|  | B6 | UL/DL | 1 | Indicates whether the PPDU is sent UL or DL.Set to 1 if the PPDU is addressed to an AP.Set to 0 otherwise.See the TXVECTOR parameter UPLINK\_FLAG. |
|  | B7–B12 | BSS Color | 6 | An identifier of the BSS.See the TXVECTOR parameter BSS\_COLOR. |
|  | B13–B19 | TXOP | 7 | Set to 127 to indicate no duration information if the TXVECTOR parameter TXOP\_DURATION is UNSPECIFIED.Set to a value less than 127 to indicate duration information for NAV settingand protection of the TXOP as follows: |
|  |  |  |  | If the TXVECTOR parameter |
|  |  |  |  | TXOP\_DURATION is less than |
|  |  |  |  | 512, then B0 is set to 0 and B1– |
|  |  |  |  | B6 is set to floor(TXOP\_DU- |
|  |  |  |  | RATION/8). |
|  |  |  |  | Otherwise, B0 is set to 1 and B1–B6 is set to floor((TXOP\_DURATION- 512)/8),whereB0 indicates TXOP length granularity. Set to 0 for 8 µs; otherwise set to 1 for 128 µs. B1–B6 indicates the scaled value of the TXOP\_DURATION. |

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1 **Table 36-19—U-SIG field of an EHT MU PPDU *(continued)***

2

3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
|  | B20–B24 | Disregard | 5 | Disregard and set to all 1s. |
| B25 | Validate | 1 | Validate and set to 1. |
| U-SIG-2 | B0–B1 | PPDU Type And Compression Mode | 2 | If B6 of U-SIG-1 is set to 0, a value of 0 indicates a DL OFDMA PPDU.A value of 1 indicates an EHT SU transmission or an EHT sounding NDP.A value of 2 indicates a non-OFDMA DL MU-MIMO transmission.NOTE—If B6 of U-SIG-1 is set to 1, a value of 0 indicates a TB PPDU.Undefined values of this field are Validate.For further clarifications on all states of this field, please refer to [Table 36-](#bookmark92) [20 (States of UL/DL and PPDU Type](#bookmark92) [And Compression Mode field)](#bookmark92). |
| B2 | Validate | 1 | Validate and set to 1. Maybe used for an expanded set of PPDU types or compressed modes in IEEE PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards. . |

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1 **Table 36-19—U-SIG field of an EHT MU PPDU *(continued)***

2

3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
|  | B3–B7 | Punctured Channel Information | 5 | If B0–B1 of U-SIG-2 is set to 1 or 2, which is the non-OFDMA case,B3–B7 points to the entry of a bandwidth dependent table (defined i[n Table 36-21 (5-bit](#bookmark93) [punctured channel indication for the non-OFDMA case in an EHT](#bookmark93) [MU PPDU)](#bookmark93)) to signal the non- OFDMA puncturing pattern of the entire PPDU bandwidth.Undefined values of this field are Validate.If B0–B1 of U-SIG-2 is set to 0, which is the OFDMA case,If B3–B5 of U-SIG-1 is set to a value between 2 and 5, which indicates an 80/160/320 MHz PPDU, B3–B6 is a 4-bit bitmap that tells which 20 MHz channel is punctured in the relevant80 MHz segment, where B3 applies to the lowest frequency 20 MHz channel and B6 to the highest frequency 20 MHz channel. For each of the bits B3–B6, a value of 0 indicates that the corresponding 20 MHz channel is punctured, and a value of 1 is used otherwise. The following allowed punctured patterns are defined for an80 MHz segment: 0111, 1011,1101, 1110, 0011, 1100, and1001. Any field values other than the allowed punctured patterns are Validate. Field value may be varied from one 80 MHz to the other.If B3–B5 of U-SIG-1 is set to 0 or 1, which indicates a 20/40 MHz PPDU, B3–B6 of U-SIG-2 are set to all 1s. Other values are Validate.B7 is Disregard and set to 1. |
| B8 | Validate | 1 | Validate and set to 1. Maybe used for an expanded set of puncturing modes in IEEE PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards. . |
| B9–B10 | EHT-SIG MCS | 2 | Indicates the MCS used for modulating the EHT-SIG. Set to 0 for EHT-MCS 0.Set to 1 for EHT-MCS 1.Set to 2 for EHT-MCS 3.Set to 3 for EHT-MCS 0 + DCM. |

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1 **Table 36-19—U-SIG field of an EHT MU PPDU *(continued)***

2

3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
|  | B11–B15 | Number Of EHT-SIG Symbols | 5 | Indicates the number of EHT-SIG symbols. Set to a value that is the number of EHT-SIG symbols minus 1. This value shall be the same in every 80 MHz segment. |
| B16–B19 | CRC | 4 | CRC for bits 0–41 of the U-SIG field (see [36.3.11.7.3 (CRC computation)](#bookmark96)). Bits 0–41 of the U-SIG field correspond to bits 0–25 of U-SIG-1 followed by bits 0–15 of U-SIG-2. |
| B20–B25 | Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

### 23 Table 36-20—States of UL/DL and PPDU Type And Compression Mode field

24

25

|  |  |
| --- | --- |
| **U-SIG fields** | **Description** |
| **UL/DL** | **PPDU Type And Compression Mode** | **EHT PPDU****type** | **EHT-SIG****present?** | **RU****allocation table present?** | **Total number of users in the PPDU** | **Note** |
| 0 (DL) | 0 | EHT MU | Yes | Yes |  1 | DL OFDMA (including non- MU-MIMO and MU-MIMO) |
| 1 | EHT MU | Yes | No | 1 | SU or NDP (Not to AP. Typically “DL”) |
| 2 | EHT MU | Yes | No |  1 | DL MU-MIMO (non- OFDMA) |
| 3 | — | — | — | — | Validate |
| 1 (UL) | 0 | EHT TB | No | — |  1 | UL OFDMA (including non- MU-MIMO and MU-MIMO) |
| 1 | EHT MU | Yes | No | 1 | SU or NDP (To AP, i.e., “UL”) |
| 2–3 | — | — | — | — | Validate |

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

### Table 36-21—5-bit punctured channel indication for the non-OFDMA case in an EHT MU

1. **PPDU**

3

4

|  |  |  |  |
| --- | --- | --- | --- |
| **PPDU****bandwidth** | **Cases** | **Puncturing pattern** | **Field value** |
| 20/40 MHz | No puncturing | [1 1 1 1] | 0 |
| 80 MHz | No puncturing | [1 1 1 1] | 0 |
| 20 MHz puncturing | [x 1 1 1] | 1 |
| [1 x 1 1] | 2 |
| [1 1 x 1] | 3 |
| [1 1 1 x] | 4 |
| 160 MHz | No puncturing | [1 1 1 1 1 1 1 1] | 0 |
| 20 MHz puncturing | [x 1 1 1 1 1 1 1] | 1 |
| [1 x 1 1 1 1 1 1] | 2 |
| [1 1 x 1 1 1 1 1] | 3 |
| [1 1 1 x 1 1 1 1] | 4 |
| [1 1 1 1 x 1 1 1] | 5 |
| [1 1 1 1 1 x 1 1] | 6 |
| [1 1 1 1 1 1 x 1] | 7 |
| [1 1 1 1 1 1 1 x] | 8 |
| 40 MHz puncturing | [x x 1 1 1 1 1 1] | 9 |
| [1 1 x x 1 1 1 1] | 10 |
| [1 1 1 1 x x 1 1] | 11 |
| [1 1 1 1 1 1 x x] | 12 |

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

### Table 36-21—5-bit punctured channel indication for the non-OFDMA case in an EHT MU

1. **PPDU *(continued)***

3

4

|  |  |  |  |
| --- | --- | --- | --- |
| **PPDU****bandwidth** | **Cases** | **Puncturing pattern** | **Field value** |
| 320 MHz | No puncturing | [1 1 1 1 1 1 1 1] | 0 |
| 40 MHz puncturing | [x 1 1 1 1 1 1 1] | 1 |
| [1 x 1 1 1 1 1 1] | 2 |
| [1 1 x 1 1 1 1 1] | 3 |
| [1 1 1 x 1 1 1 1] | 4 |
| [1 1 1 1 x 1 1 1] | 5 |
| [1 1 1 1 1 x 1 1] | 6 |
| [1 1 1 1 1 1 x 1] | 7 |
| [1 1 1 1 1 1 1 x] | 8 |
| 80 MHz puncturing | [x x 1 1 1 1 1 1] | 9 |
| [1 1 x x 1 1 1 1] | 10 |
| [1 1 1 1 x x 1 1] | 11 |
| [1 1 1 1 1 1 x x] | 12 |
| 320–80–40 | [x x x 1 1 1 1 1] | 13 |
| [x x 1 x 1 1 1 1] | 14 |
| [x x 1 1 x 1 1 1] | 15 |
| [x x 1 1 1 x 1 1] | 16 |
| [x x 1 1 1 1 x 1] | 17 |
| [x x 1 1 1 1 1 x] | 18 |
| [x 1 1 1 1 1 x x] | 19 |
| [1 x 1 1 1 1 x x] | 20 |
| [1 1 x 1 1 1 x x] | 21 |
| [1 1 1 x 1 1 x x] | 22 |
| [1 1 1 1 x 1 x x] | 23 |
| [1 1 1 1 1 x x x] | 24 |

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1. NOTE—In the puncturing patterns in the above table, a “1” denotes a nonpunctured subchannel and an “x” denotes a
2. punctured subchannel. The puncturing granularity for 80 MHz and 160 MHz PPDU bandwidth is 20 MHz, and the
3. puncturing granularity for 320 MHz PPDU bandwidth is 40 MHz. 4
4. The U-SIG field for an EHT TB PPDU contains the fields listed in [Table 36-22 (U-SIG field of an EHT TB](#bookmark94)
5. [PPDU)](#bookmark94). The version independent bits are B0–B19. The rest of the bits are version dependent.

7

8

9

### 10 Table 36-22—U-SIG field of an EHT TB PPDU

11

12

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
| U-SIG-1 | B0–B2 | Version Identifier | 3 | Differentiate between different PHY |
| clauses. Set to 0 for EHT. |
|  |  |  |  | Values 1–7 are Validate. |
|  | B3–B5 | BW | 3 | Set to 0 for 20 MHz. |
|  |  |  |  | Set to 1 for 40 MHz. |
|  |  |  |  | Set to 2 for 80 MHz. |
|  |  |  |  | Set to 3 for 160 MHz. |
|  |  |  |  | Set to 4 for 320 MHz-1. |
|  |  |  |  | Set to 5 for 320 MHz-2. |
|  |  |  |  | Values 6 and 7 are Validate. |
|  | B6 | UL/DL | 1 | Set to 1 to indicate that the PPDU is |
|  |  |  |  | addressed to the AP. |
|  | B7–B12 | BSS Color | 6 | An identifier of the BSS. |
| See the TXVECTOR parameter |
|  |  |  |  | BSS\_COLOR. |
|  | B13–B19 | TXOP | 7 | Set to 127 to indicate no duration |
|  |  |  |  | information if the TXVECTOR |
|  |  |  |  | parameter TXOP\_DURATION is |
|  |  |  |  | UNSPECIFIED. |
|  |  |  |  | Set to a value less than 127 to indicate |
|  |  |  |  | duration information for NAV setting |
|  |  |  |  | and protection of the TXOP as |
|  |  |  |  | follows: |
|  |  |  |  | If the TXVECTOR parameter |
|  |  |  |  | TXOP\_DURATION is less than |
|  |  |  |  | 512, then B0 is set to 0 and B1– |
|  |  |  |  | B6 is set to floor(TXOP\_DU- |
|  |  |  |  | RATION/8). |
|  |  |  |  | Otherwise, B0 is set to 1 and |
|  |  |  |  | B1–B6 is set to |
|  |  |  |  | floor((TXOP\_DURATION- |
|  |  |  |  | 512)/8), |
|  |  |  |  | where |
|  |  |  |  | B0 indicates TXOP length |
|  |  |  |  | granularity. Set to 0 for 8 µs; |
|  |  |  |  | otherwise set to 1 for 128 µs. |
|  |  |  |  | B1–B6 indicates the scaled value |
|  |  |  |  | of the TXOP\_DURATION. |
|  | B20–B25 | Disregard | 6 | Disregard. |
| U-SIG-2 | B0–B1 | PPDU Type And Compressed Mode | 2 | Set to a value of 0 for a TB PPDU. For further clarification on all states of this field, please refer to [Table 36-20](#bookmark92) [(States of UL/DL and PPDU Type](#bookmark92) [And Compression Mode field)](#bookmark92). |

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1 **Table 36-22—U-SIG field of an EHT TB PPDU *(continued)***

2

3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
|  | B2 | Validate | 1 | Validate and set to 1. Maybe used for an expanded set of PPDU types or compressed modes in IEEE PHY clauses that are defined for 2.4, 5 and 6 GHz spectrum from clause 36 onwards.  |
| B3–B6 | Spatial Reuse 1 | 4 | Indicates whether or not specific spatial reuse modes are allowed in a subband of the PPDU during the transmission of this PPDU, and if PSR spatial reuse is allowed, indicates a value that is used to determine a limit on the transmit power of the PSRT PPDU.If the Bandwidth field indicates 20 MHz or 40 MHz, then this field applies to the first 20 MHz subband.If the Bandwidth field indicates 80 MHz, then this field applies to the first 40 MHz subband of the 80 MHz operating band.If the Bandwidth field indicates 160 MHz, then this field applies to the first 80 MHz subband of the 160 MHz operating band.If the Bandwidth field indicates 320 MHz-1 or 320 MHz-2, then this field applies to the first160 MHz subband of the 320 MHz operating band.Set to the value of the SPATIAL\_REUSE(1) parameter of the TXVECTOR, which contains a value from Table 27-23 (Spatial Reuse field encoding for an HE TB PPDU) for an HE TB PPDU (see26.11.6 (SPATIAL\_REUSE)) and26.10 (Spatial reuse operation)). |

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1 **Table 36-22—U-SIG field of an EHT TB PPDU *(continued)***

2

3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
|  | B7–B10 | Spatial Reuse 2 | 4 | Indicates whether or not specific spatial reuse modes are allowed in a subband of the PPDU during the transmission of this PPDU, and if PSR spatial reuse is allowed, indicates a value that is used to determine a limit on the transmit power of the PSRT PPDU.If the Bandwidth field indicates 40 MHz, this field applies to the second 20 MHz subband. If the STA operating channel width is 20 MHz, then this field is set to the same value as the Spatial Reuse 1 field. If the STA operating channel width is40 MHz in the 2.4 GHz band, this field is set to the same value as the Spatial Reuse 1 field.If the Bandwidth field indicates 80 MHz, then this field applies to the second 40 MHz subband of the 80 MHz operating band. If the Bandwidth field indicates 160 MHz, then this field applies to the second 80 MHz subband of the 160 MHz operating band. If the Bandwidth field indicates 320 MHz-1 or 320 MHz-2, then this field applies to the second 160 MHz subband of the320 MHz operating band.Set to the value of the SPATIAL\_REUSE(1) parameter of the TXVECTOR, which contains a value from Table 27-23 (Spatial Reuse field encoding for an HE TB PPDU) for an HE TB PPDU (see26.11.6 (SPATIAL\_REUSE) and26.10 (Spatial reuse operation)). |
| B11–B15 | Disregard | 5 | Disregard. |
| B16–B19 | CRC | 4 | CRC for bits 0–41 of the U-SIG field (see [36.3.11.7.3 (CRC computation)](#bookmark96)). Bits 0–41 of the U-SIG field correspond to bits 0–25 of U-SIG-1 followed by bits 0–15 of U-SIG-2. |
| B20–B25 | Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1. The U-SIG field for an ER preamble contains the fields listed in [Table 36-23 (U-SIG field of an ER](#bookmark95)
2. [preamble)](#bookmark95). The version independent bits are B0–B19. The rest of the bits are version dependent.

3

4

### 5 Table 36-23—U-SIG field of an ER preamble

6

7

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
| U-SIG-1 | B0–B2 | Version Identifier | 3 | Differentiate between different PHY |
| amendments. |
|  |  |  |  | NOTE—Expected to take a value |
|  |  |  |  | other than 0 as EHT does not define |
|  |  |  |  | an ER PPDU. |
|  | B3–B5 | BW | 3 | Set to 0 for 20 MHz. |
|  |  |  |  | Set to 1 for 40 MHz. |
|  |  |  |  | Set to 2 for 80 MHz. |
|  |  |  |  | Set to 3 for 160 MHz. |
|  |  |  |  | Set to 4 for 320 MHz-1. |
|  |  |  |  | Set to 5 for 320 MHz-2. |
|  |  |  |  | Values 6 and 7 are Validate. |
|  | B6 | UL/DL | 1 | Indicates whether the PPDU is sent |
|  |  |  |  | UL or DL. Set to 1 if the PPDU is |
|  |  |  |  | addressed to an AP. Set to 0 otherwise. |
|  |  |  |  | See the TXVECTOR parameter |
|  |  |  |  | UPLINK\_FLAG. |
|  | B7–B12 | BSS Color | 6 | An identifier of the BSS. |
|  |  |  |  | See the TXVECTOR parameter |
|  |  |  |  | BSS\_COLOR. |
|  | B13–B19 | TXOP | 7 | Set to 127 to indicate no duration |
|  |  |  |  | information if the TXVECTOR |
|  |  |  |  | parameter TXOP\_DURATION is |
|  |  |  |  | UNSPECIFIED. |
|  |  |  |  | Set to a value less than 127 to indicate |
|  |  |  |  | duration information for NAV setting |
|  |  |  |  | and protection of the TXOP as |
|  |  |  |  | follows: |
|  |  |  |  | If the TXVECTOR parameter |
|  |  |  |  | TXOP\_DURATION is less than |
|  |  |  |  | 512, then B0 is set to 0 and |
|  |  |  |  | B1–B6 is set to floor(TXO- |
|  |  |  |  | P\_DURATION/8). |
|  |  |  |  | Otherwise, B0 is set to 1 and |
|  |  |  |  | B1–B6 is set to |
|  |  |  |  | floor((TXOP\_DURATION- |
|  |  |  |  | 512)/8), |
|  |  |  |  | where |
|  |  |  |  | B0 indicates TXOP length |
|  |  |  |  | granularity. Set to 0 for 8 µs; |
|  |  |  |  | otherwise set to 1 for 128 µs. |
|  |  |  |  | B1–B6 indicates the scaled value |
|  |  |  |  | of the TXOP\_DURATION. |
|  | B20–B25 | Disregard | 6 | Disregard. |

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

36

37

38

39

40

41

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1 **Table 36-23—U-SIG field of an ER preamble *(continued)***

2

3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Two parts of U-SIG** | **Bit** | **Field** | **Number of bits** | **Description** |
| U-SIG-2 | B0–B15 | Disregard | 16 | Disregard. |
| B16–B19 | CRC | 4 | CRC for bits 0–41 of the U-SIG field (see [36.3.11.7.3 (CRC computation)](#bookmark96)). Bits 0–41 of the U-SIG field correspond to bits 0–25 of U-SIG-1 followed by bits 0–15 of U-SIG-2. |
| B20–B25 | Tail | 6 | Used to terminate the trellis of the convolutional decoder. Set to 0. |

4

5

6

7

8

9

10

11

12

13

14

15

16

17

18

### 19 36.3.11.7.3 CRC computation

20

21

1. The CRC computation defined in this subclause applies to U-SIG, the Common field of EHT-SIG, and the
2. User Block field of EHT-SIG.

24

25 The CRC is calculated over bits 0 to 41 of the U-SIG field. Bits 0 to 41 of the U-SIG field correspond to bits

26

27 0–25 of U-SIG-1 followed by bits 0–15 of U-SIG-2.

28

29 The value of the CRC field shall be the 1s complement of

30

31

32 *crc**D* =

33

34 where

35

*i*

*M**D* + *I**D**D*8 mod *G**D*

36

37 *M**D*

38

39

*L*

= 

*i* = 0

*mL* – *i D*

40 *I**D*

41

42

*L*

=  *Di*

*i* = *L* – 7

1. *G**D* is defined in 19.3.9.4.4 (CRC calculation for HT-SIG).
2. *crc**D* = *c D*7 + *c D*6 +  + *c D* + *c*

45 0 1 6 7

46 *mL*

47

48

is the serial input shown in [Figure 36-33 (CRC calculation)](#bookmark97).

49 The CRC field is transmitted from *c*4 to *c*7 with *c*7 first.

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1. [Figure 36-33 (CRC calculation)](#bookmark97) shows the operation of the CRC. First, the shift register is reset to all 1s. The
2. bits are then passed through the XOR operation at the input. When the last bit has entered, the output is
3. generated by shifting the bits out of the shift register, *c* first, through an inverter.

7

4

5

6

*m*L to

*m*0

The feedback term is set to 0 during the shifting out of the result.

0

al ut

*c7*

*c6*

*c5*

*c4*

*c3*

*c2*

*c1*

*c0*

Serial Output

7

8

1. Seri
2. Inp

11

12

13

14

15

### 16 Figure 36-33—CRC calculation

17

18

19 As an example, if bits *m*0 *m*1  *m*41 are given by {1 1 0 1 1 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 1 1 0 0 0 0 0

20

21 0 0 0 0 0 0 1 0 0 1 1 0 1 0}, the output bits *B*7  *B*4 , where *B*7 is outputted first, are {0 1 1 1}.

22

### 23 36.3.11.7.4 Encoding and modulation

24

25

1. For an EHT MU PPDU and EHT TB PPDU, the U-SIG field is composed of two parts, U-SIG-1 and
2. U-SIG-2, each containing 26 data bits. U-SIG-1 is transmitted before U-SIG-2. The data bits of the U-SIG
3. OFDM symbols shall be BCC encoded at rate, *R* = 1  2 , interleaved, mapped to a BPSK constellation, and

29

1. have pilots inserted following the steps described in 17.3.5.6 (Convolutional encoder), 27.3.12.8 (BCC
2. interleavers), 17.3.5.8 (Subcarrier modulation mapping), and 17.3.5.9 (Pilot subcarriers), respectively. This
3. process happens on a per-80 MHz frequency segment basis as U-SIG field may have different contents in
4. different 80 MHz frequency segments, while always having identical content in every 20 MHz segment of a

34

1. given 80 MHz segment. For every 80 MHz segment in the EHT PPDU, the first and second half of the
2. stream of 104 complex numbers generated by these steps (before pilot insertion) is divided into two groups
3. of 52 complex numbers, where respectively, the first 52 complex numbers form the first OFDM symbol of
4. U-SIG and the second 52 complex numbers form the second OFDM symbol of U-SIG.

39

40

1. For U-SIG in 80 MHz frequency segment *i*80*FS* , the complex number assigned to the *k-*th data subcarrier of
2. the *n-*th symbol is denoted as *di*80 *FS* . The time domain waveform for the U-SIG field of an EHT MU PPDU

*k* *n*

43

44 and EHT TB PPDU, transmitted on frequency segment *i*80*FS* and transmit chain *iTX* , shall be as specified in

45

46 [Equation (36-11)](#bookmark73).

47

48

1. *i*80*FS* *iTX*

*r* *t* =

1. U-SIG

51

52

53 1

1

(36-18)

28

1. *w*



 *T*

1. Tone 20MHz

*SYML*

*t* – *nTSYML* Pre-EHT  

1. *NTX*  *N*U-SIG  *n* = 0
2. *N*20MHz
3. *i*

*D*

*iBW*  20MHz *k* = –28

*i*

*CS*

59 

60

61

62

63

*k* – *K*Shift *iBW*  BW

80*FS*

*k* *n* 20

+ *pn* + 2

*Pk* exp*j*2*k* – *K*

Shift

*iBW*



*F* Pre-EHT

*t* – *nT*

*SYML*–*T*

*GI* Pre-EHT

–*T TX* 

64 where

65

1 *TSYML*

2

is given in [Table 36-9 (Timing-related constants)](#bookmark54).

3 *K* = *N*20MHz – 1 – 2*i*  32

4

5 *Di*80*FS*

0

=

*k* = 0 7 21

6 *k* *n* 20 *Di*80 *FS* 

otherwise

7  *Mr* *k* *n*

20

8

9

10

11

12 *Mr* *k*

20

13

14

15

16

*k* + 28

*k* + 27



*k* + 26

= *k* + 25



*k* + 24



*k* + 23

–28  *k*  –22

–20  *k*  –8

–6  *k*  –1

1  *k*  6

8  *k*  20

22  *k*  28

17 Pre-EHT

18

19

is the power scale factor of the pre-EHT modulated fields within an OFDM symbol for an EHT TB PPDU defined in [36.3.10 (Mathematical description of signals)](#bookmark60).

1. *Pk* and *pn* are defined in 17.3.5.10 (OFDM modulation).
2. Tone

*N*

1. U-SIG

23

1. *i*

*T*

*TX*

1. *CS*

26

27

28

is defined in [Table 36-17 (Number of modulated subcarriers and guard interval duration values](#bookmark74) [for EHT PPDU fields)](#bookmark74).

represents the cyclic shift for transmit chain *iTX* with a value given in [36.3.11.2.1 (Cyclic shift](#bookmark78) [for pre-EHT modulated fields)](#bookmark78).

1. For an ER preamble, the U-SIG field is composed of four parts, i.e., U-SIG-1, U-SIG-1-R, U-SIG-2, and
2. U-SIG-2-R, each part containing 26 data bits. These four parts are transmitted sequentially from U-SIG-1 to
3. U-SIG-2-R. The data bits of U-SIG-1 and U-SIG-2 shall be BCC encoded at rate *R*

32

= 1  2 , interleaved,

1. mapped to a BPSK constellation, and have pilots inserted. U-SIG-1-R has the same encoded bits as U-SIG-1
2. and the encoded bits shall be mapped to a QBPSK constellation without interleaving and have pilots
3. inserted. The constellation mapping of the U-SIG field in an ER preamble is the same as that of the
4. HE-SIG-A field in an HE ER SU PPDU, and is shown in [Figure 36-34 (Data subcarrier constellation of U-](#bookmark98)
5. [SIG symbols)](#bookmark98). The QBPSK constellation on U-SIG-1-R is used to differentiate an ER preamble from an

38

1. EHT MU PPDU and an EHT TB PPDU. U-SIG-2-R has the same encoded bits as U-SIG-2 and the encoded
2. bits shall be mapped to a BPSK constellation without interleaving and have pilots inserted. BCC encoding,
3. data interleaving, constellation mapping, and pilot insertion follow the steps described in

42

43

44

45

46

47

48

49

50

51

52

53

54

55

56

57

58

59

60

61

62

63

64

65

1. 17.3.5.6 (Convolutional encoder), 27.3.12.8 (BCC interleavers), 17.3.5.8 (Subcarrier modulation mapping),
2. and 17.3.5.9 (Pilot subcarriers), respectively.

3

4

U-SIG-2

U-SIG-1

1. EHT MU PPDU
2. and EHT TB PPDU

7

8

9

10

11

12

13

14

15 ER Preamble

16

17

18

19

20

21

22

Q Q

I I

-1 +1

-1 +1

U-SIG-1

U-SIG-1-R

U-SIG-2-R

U-SIG-2

Q Q Q

-1 +1

-1 +1

-1 +1

Q

+1

-1

I I I I

### 23 Figure 36-34—Data subcarrier constellation of U-SIG symbols

24

25

26

1. For U-SIG in 80 MHz frequency segment *i*80*FS* , the complex number assigned to the *k*-th data subcarrier of
2. the *n*-th symbol is denoted as *di*80 *FS* . The time domain waveform for the U-SIG field of an EHT ER SU

*k* *n*

29

30 PPDU, transmitted on frequency segment

31

32 [Equation (36-19)](#bookmark99).

33

34

*i*80*FS*

3

 *T*

and transmit chain

*iTX* , shall be as specified in

1. *i*80*FS* *iTX*

*r* *t* =

1. U-SIG

----------------------------- *w*

 *SYML*

*t* – *nTSYML* 

Pre-EHT

(36-19)

1. *NTX*
* *N*

38

39 28

Tone U-SIG

* -------2--0--M H--z-- *n* = 0

*N*20MHz

40 *R Di*80*FS* + *p*

*P* exp*j*2*k*

*t* – *nT* –*T*

–*TiTX* 

41

42

43

44 where

45



*k* = –28

*n k* *n* 20

*n* + 2 *k*

*F* Pre-EHT

*SYML*

*GI* Pre-EHT *CS*

46 *Rn*

47

is a phase rotation vector defined as 1 *j* 1 1 .